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Simplice A Asongu

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New Empirics of monetary policy dynamics: evidence from the CFA franc zones

Simplice A. Asongu
African Governance and Development Institute,
P.O. Box 18 SOA/ 1365 Yaoundé, Cameroon.
E-mail: asongusimplice@yahoo.com

Abstract
Purpose – A major lesson of the EMU crisis is that serious disequilibria in a monetary union result from arrangements not designed to be robust to a variety of shocks. With the specter of this crisis looming substantially and scarring existing monetary zones, the present study has complemented existing literature by analyzing the effects of monetary policy on economic activity (output and prices) in the CEMAC and UEMOA CFA franc zones.

Design/methodology/approach – VARs within the frameworks of VECMs and Granger causality models are used to estimate the long-run and short-run effects respectively. Impulse response functions are further used to assess the tendencies of significant Granger causality findings. A battery of robustness checks are also employed to ensure consistency in the specifications and results.

Findings – *Hypothesis 1*: Monetary policy variables affect prices in the long-run but not in the short-run in the CFA zones (*Broadly untrue*). This invalidity is more pronounced in CEMAC (relative to all monetary policy variables) than in UEMOA (with regard to financial dynamics of activity and size). *Hypothesis 2*: Monetary policy variables influence output in the short-term but not in the long-run in the CFA zones. Firstly, the absence of co-integration among real output and the monetary policy variables in both zones confirm the long-term dimension of the hypothesis on the neutrality of money. The validity of its short-run dimension is more relevant in the UEMOA zone (with the exception of overall money supply) than in the CEMAC zone (in which only financial dynamics of 'financial system efficiency' and financial activity support the hypothesis).

Practical Implications – (1) Compared to the CEMAC region, the UEMOA zone's monetary authority has more policy instruments for offsetting output shocks but fewer instruments for the management of short-run inflation. (2) The CEMAC region is more inclined to non-traditional policy regimes while the UEMOA zone dances more to the tune of traditional discretionary monetary policy arrangements. A wide range of policy implications are discussed. Inter alia: implications for the long-run neutrality of money and business cycles; implications for credit expansions and inflationary tendencies; implications of the findings to the ongoing debate; country-specific implications and measures of fighting surplus liquidity.

Originality/value – By using a plethora of hitherto unemployed financial dynamics (that broadly reflect money supply), we have provided a significant contribution to the empirics of monetary policy. The conclusion of the analysis is a valuable contribution to the scholarly and policy debate on how money matters as an instrument of economic activity in developing countries and monetary unions.

JEL Classification: E51; E52; E58; E59; O55
Keywords: Monetary Policy; Banking; Inflation; Output effects; Africa

1. Introduction

The European Monetary Union (EMU) crisis is looming substantially and scarring existing monetary zones. The crisis has led to renewed interest in the economics of monetary union. This has resurfaced many issues in the debate on monetary policy. First and foremost, whereas in large industrial economies, changes in monetary policy affect real economic activity in the short-run (but only prices in the long-term), in transition (and developing) countries the question of whether monetary policy variables have an incidence on output in the short-run has been open to debate (Starr, 2005). Secondly, the evidence of real effects in developed countries is consistent with the idea that monetary policy can be used to counter aggregate shocks. From a traditional perspective, economic theory suggest that money affects the business cycle but not the long-term potential real output; an indication that monetary policy is neutral in the distant future. Despite the substantially documented theoretical and empirical consensus on this long-term neutrality (Lucas, 1980, Olekalns, 1996; Sarletis & Koustas, 1998; Bernanke & Mihov, 1998; Bullard, 1999; Gerlach & Svensson, 2003; Bae et al., 2005; Nogueira, 2009), the role of money as an informational variable for decision making has remained open to scholarly debate (Roffia & Zaghini, 2008; Nogueira, 2009; Bhaduri & Durai, 2012)[1]. Thirdly, the potential incidence of monetary policy variables on prices is also less clear. For example, in countries that have experienced significant inflation or in which labor markets are substantially slack, prices and wages are less likely to be particularly sticky so that, monetary policy variations could pass quickly through prices and have very weak real effects (Gagnon & Ihrig, 2004). Moreover, the globalization of financial markets undercut the potential of independent monetary policy by significantly dissipating the ability of small-open countries (economies) to determine interest rates independently of world markets (Dornbusch, 2001; Frankel et al., 2004).

[1] Accordingly, the empirical literature reveals mixed results and the outcomes are contingent on selected countries and historical periods under investigation (Dwyer & Hafer, 1999; Stock & Watson, 1999; Trecroci & Vega-Croissier, 2000; Leeper & Roush, 2002; Bae et al., 2005).

As far as we have reviewed, few studies have recently examined existing monetary unions in light of the EMU crisis. A strand of the literature has investigated the feasibility of the proposed African monetary unions with regard to the optimality of currency areas (Asongu, 2013a) and adjustments to shocks (Alagidede et al., 2012). From the depth of our knowledge, only one paper has focused on CFA zones in light the crisis (Asongu, 2013b). This leaves room for at least five major challenges in the literature.

Firstly, but for a few exceptions (Moosa, 1997; Bae & Ratti, 2000; Starr, 2005; Nogueira, 2009), the literature on the long-term economic significance of money has abundantly focused on developed economies. Evidence provided by these works may not be quite relevant for African countries due to asymmetric financial dynamics. For example, financial depth in the perspective of deposits (or liabilities) is not equivalent to money supply in African countries because a great chunk of the monetary base does not transit via the banking sector (Asongu, 2011). Secondly, the empirical investigation on monetary aggregates has failed to take into consideration other proxies that are consistently exogenous to money supply. Accordingly, financial intermediary dynamics of efficiency (at banking and financial system levels), activity (from banking and financial system perspectives), and size substantially affect the velocity of money. Moreover, financial allocation efficiency is a significant issue in African countries because of the substantially documented surplus liquidity concerns (Saxegard, 2006; Fouda, 2009). Thirdly, soaring food prices that have recently marked the geopolitical landscape of Africa have not been braced adequately with short-term monetary policy measures to offset the rising price tide[2]. Fourthly, with the EMU crisis looming, understanding how monetary policy affects economic activity in existing monetary zones is a key concern in scholarly and policy making circles. Fifthly, the extent to which monetary policy influences output in the short-term and prices in the long-run in

[2] According to the Director General of the International Food Policy Research Institute, monetary and exchange rate responses were not effective in curtailing food inflation (Von Braun, 2008).

developing countries remains open to debate. Hence, this paper is an extension of the scholarly and policy debate on how money matters in economic activity.

Accordingly, the purpose of the present study is to complement existing literature by assessing the five challenges above in the CFA zones. A major lesson of the EMU crisis is that serious disequilibria in a monetary union result from arrangements not designed to be robust to a variety of shocks (Asongu, 2013b). We also contribute to the empirics of monetary policy by using hitherto unemployed aggregate monetary policy variables. The rest of the paper is organized as follows. Section 2 presents the theoretical and empirical underpinnings of the debate. The intuition motivating the empirics, data and the methodology are discussed in Section 3. Empirical analysis is covered in Section 4. Section 5 concludes.

2. Theoretical and empirical highlights

2.1 The debate

For the interest of organization, we present the debate partially motivating the study in two strands: the traditional discretionary monetary policy strand and, the second strand of nontraditional policy regimes that limit the ability of monetary authorities to use policy in offsetting output fluctuations.

In recent years, the rewards of shifting from traditional discretionary monetary policy arrangements (that favor commitments to price stability and international economic integration such as monetary unions, inflation targeting, dollarization…etc) have been substantially covered in the literature. Accordingly, a positive side of discretionary policy is that, the monetary authority can use policy instruments to offset adverse shocks to output by either pursuing expansionary (when output is below its potential) or contractionary (when output is above its potential) policies. For example, in the former situation, a policy-controlled interest rate can be lowered in an effort to reduce commercial interest rates and stimulate aggregate spending. On the contrary, a monetary expansionary policy that lowers the real

exchange rate could boost demand for output by improving the competitiveness of a country's products in domestic and world markets (Starr, 2005). In the same vein, a flexible countercyclical monetary policy can be practiced with inflation targeting (Ghironi & Rebucci, 2000; Mishkin, 2002; Cavoli & Rajan, 2008; Cristadoro & Veronese, 2011; Levine, 2012).

The second strand on nontraditional policy regimes limits the ability of monetary authorities to use policy to offset output fluctuations. Accordingly, the degree by which a given country can instrument monetary policy to influence output in the short-run is an open debate. Studies in the USA have concluded that a decline in the key interest rate controlled by the Federal Reserve tends to boost output over the next 2-3 years, but the effect dissipates thereafter so that the long-term impact is limited to prices (Starr, 2005). A wealth of literature has focused on the short-run impact of monetary policy on output in other countries to assess whether the effects are similar to those in the USA. Conflicting results have been found in 17 industrialized countries (Hayo, 1999). Moreover, studies in two middle income countries have found no evidence of Granger causality flowing from money to output, irrespective of the measurement of money used (Agenor et al., 2000). Hafer & Kutan (2002) have concluded that interest rate generally has a relatively more important mission in explaining output in twenty OECD[3] countries whereas, Ganev et al. (2002) have found no such evidence in Central and Eastern Europe. Though the International Monetary Fund (IMF) places great emphasis on monetary policy in its programs (for developing countries, especially sub-Saharan Africa (SSA)) because it views such policies as crucial in managing inflation and stabilizing exchange rates, according to Weeks (2010), such an approach is absurdly inappropriate since the vast majority of governments in SSA lack the instruments to make monetary policy effective[4].

[3] Organization for Economic Co-operation and Development.

[4] Weeks (2010) postulates that SSA lacks two main channels for implementing monetary policy: (1) trying to influence the creation of private credit through so-called open market operations or; (2) seeking to influence the

2.2 Monetary policy in Africa

We discuss two country-specific conflicts in the first two strands, African monetary policy issues and resulting testable hypotheses motivating the empirical underpinnings of the study in the third and fourth strands respectively, before finally highlighting the empirics in the fifth strand.

Khan (2011) has recently investigated the nexus between GDP growth and different monetary aggregates in 20 SSA economies and found empirical support for the hypothesis that credit-growth is more closely linked than money-growth to the growth of real GDP. Mangani (2011) has assessed the effects of monetary policy on prices in Malawi and concluded on a lack of unequivocal evidence in support of the conventional channel of the policy transmission. The results suggest that exchange rate have been the most important variable in forecasting prices. Policy implications from the study recommend authorities to be more concerned with imported cost-push inflation that with demand-pull inflation[5]. In a slight contradiction, Ngalawa & Viegi (2011) have also examined the process via which monetary policy affects economic activity in Malawi and found that the bank rate to be the more effective measure of monetary policy than reserve money.

Beside Malawi, some studies have also exclusively focused on South Africa: with Gupta et al. (2010a) finding that house price inflation was negatively related to monetary policy shocks; Gupta et al. (2010b) showing that during the period of financial liberalization, interest rate shocks had relatively stronger effects on house price inflation irrespective of

borrowing rates for private sector by adjusting the interest rate at which commercial banks can borrow from the central bank.

[5] Consistent with Mangani (2011), in the short-run, pursuing a prudent exchange rate policy that recognizes the country's precarious foreign reserve position could be critical in deepening domestic price stability. Beyond the short-run, policy stability could be sustained through the implementation of policies directed towards the construction of a strong foreign exchange reserve base (as well as developing a sustainable approach to the country's reliance on development assistance).

house sizes and; Ncube & Ndou (2010) complementing Gupta et al. (2010ab)[6] with the suggestion that the direct effects of high interest rates on consumption appear to be more important in transmitting monetary policy to the economy than through indirect effects. Therefore, it can be inferred that monetary policy tightening can marginally weaken inflationary pressures (arising from excessive consumption) operating via house wealth and the credit channel. In order to demonstrate that monetary expansions and contractions may have different effects in different regions of the same country, Fielding & Shields (2005) have estimated the size of asymmetries across the 9 provinces of South Africa (over the period 1997-2005) and found substantial differences in the response of prices to monetary policy.

The third strand focuses on issues of monetary policy effectiveness in targeting output and prices. Whereas a key economic risk is inflation, a weak monetary policy could also seriously exacerbate economic risks (The Economist, 2012). In line with Saxegaard (2006), going beyond acknowledging the threat of increasing inflation, several authors have observed that the abundance of liquidity is likely to have adverse effects on the ability of monetary policy to influence demand conditions and hence, stabilize the economy. Agénor et al. (2004) for example have noted that if banks already hold liquidity in excess of requirements, attempts by the monetary authorities to increase liquidity in an attempt to stimulate aggregate demand will prove largely ineffective. In the same vein, Nissanke & Aryeetey (1998) argue that in the presence of excess liquidity, it becomes difficult to effectively regulate money supply using the required reserve ratio and the money multiplier. Hence, one would expect excess liquidity to weaken the monetary policy transmission mechanism and consequently the use of monetary policy for stabilization purposes is undermined. Recent African studies focusing on monetary zones have established a broad absence of convergence of monetary policy variables in the CFA zones (Asongu, 2013b) and Fouda (2009) has emphasized excess

[6] While Gupta et al. (2010a,b) do not quantify the indirect effects of interest rate changes working through changes in house prices on consumer spending, Ncube & Ndou (2010) fill this gap by estimating and quantifying the role of house wealth in South Africa using disaggregated house prices.

liquidity issues in one of these CFA zones. A recent short-run Schumpeterian trip to embryonic African monetary zones has presented mixed results on the effectiveness of monetary policy in managing short-run output (Asongu, 2013c). Causality analysis is performed with 7 financial development and 3 growth indicators in the proposed West African Monetary Zone (WAMZ) and East African Monetary Zone (EAMZ). Results of the EAMZ are broadly consistent with the traditional discretionary monetary policy arrangements whereas those of the WAMZ are in line with the non-traditional strand of regimes in which, policy instruments in the short-run cannot be used to offset adverse shocks to output. In a nut shell, the surplus liquidity issues have generally been confirmed in recent African monetary literature (Asongu, 2013d), especially with respect to targeting inflation (Asongu, 2013e). This latter strand of studies has not included the CFA zones in their datasets in light of the Mundell conjecture (1972)[7] and relative inflation certainty (Asongu, 2011)[8]. This leaves room for assessing the CFA zones.

In light of the points presented in the introduction, the debate and issues raised in the third strand above, the following hypotheses will be tested in the empirical section.

Hypothesis 1: Monetary policy variables affect prices in the long-run but not in the short-run in the CFA zones.

Hypothesis 2: Monetary policy variables influence output in the short-term but not in the long-run in the CFA zones.

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[7] "*The French and English traditions in monetary theory and history have been different… The French tradition has stressed the passive nature of monetary policy and the importance of exchange stability with convertibility; stability has been achieved at the expense of institutional development and monetary experience. The British countries by opting for monetary independence have sacrificed stability, but gained monetary experience and better developed monetary institutions*." (Mundell, 1972, pp. 42-43).

[8] "*The dominance of English common–law countries in prospects for financial development in the legal–origins debate has been debunked by recent findings. Using exchange rate regimes and economic/monetary integration oriented hypotheses, this paper proposes an 'inflation uncertainty theory' in providing theoretical justification and empirical validity as to why French civil–law countries have higher levels of financial allocation efficiency. Inflation uncertainty, typical of floating exchange rate regimes accounts for the allocation inefficiency of financial intermediary institutions in English common–law countries. As a policy implication, results support the benefits of fixed exchange rate regimes in financial intermediary allocation efficiency"* Asongu (2011, p.1).

Consistent with the position of Weeks (2010) on the inherent ineffectiveness of monetary policy in African countries discussed above, the insights from the 'Blinder credit-rationing model' are useful in motivating the intuition for African empirics. According to Blinder (1987), a rethinking of novel monetary policy dynamics is needed at times: "*The reader should understand that this is merely an expositional device. I would not wish to deny that the interest elasticity and expectational error mechanisms have some validity. But the spirit of this paper is that those mechanisms do not seem important enough to explain the deep recessions that are apparently caused by central bank policy*" (p. 2). The postulation of Blinder is even more relevant in recent memory when existing monetary and exchange rate responses have not been effective in addressing the recent food inflation (Von Braun, 2008).

3. Intuition, Data and Methodology

3.1 Intuition for the empirics

Whereas there is a vast empirical work on the incidence of monetary policy on economic activity based on aggregate indicators of money supply, there is still (to the best of our knowledge) no employment of fundamental financial performance dynamics (that are exogenous to money supply) in the assessment of the long- and short-run effects of monetary policy on output and prices. With this in mind, we are aware of the risks of "doing measurement without past empirical basis" and postulate that reporting facts even in the absence of past supporting studies (in the context of an outstanding theoretical model) is a useful scientific activity. In addition, applied econometrics has other tasks than the mere validation or refutation of economic theories with existing expositions and prior analytical frameworks (Asongu, 2012; 2013fg). Hence, we discuss the economic/monetary intuition motivating the empirical underpinnings.

From a broad standpoint, money supply can be viewed in terms of financial depth, financial allocation efficiency, financial activity and financial size. (1) Financial intermediary

depth could be defined both from an overall economic perspective and a financial system viewpoint. The justification for this distinction (as will be detailed in the data section) is straightforward: unlike the developed world, in developing countries a great chunk of the monetary base does not transit through the banking sector (Asongu, 2011). (2) Financial allocation efficiency that reflects the fulfillment of the fundamental role of banks (in transforming mobilized deposits into credit for economic operators) could be intuitively conceived as the ability of financial institutions to increase the velocity of money. (3) Financial activity (or credit availability) reflects the ability of banks to grant credit to economic operators and hence, the quantity of money in the economy. (4) Financial size mirrors the proportion of credit allocated by banking institutions to total assets in the financial system. Total assets here refer to 'deposit bank assets' plus 'central bank assets'. Hence, it could be inferred that the above financial intermediary performance dynamics are exogenous to money supply and monetary policy.

The choice of the monetary policy variables is broadly consistent with the empirical underpinnings of recent African monetary literature targeting inflation (Asongu, 2013d, e) and real GDP output (Asongu, 2013c). Accordingly, we are not the first to think out of the box when it comes to the empirics of monetary policy. Blinder (1987) in assessing the effects of monetary policy on economic activity completely banished interest rate elasticities: "*In order to make credit rationing mechanism stand out in bold relief, most other channels of monetary policy (such as interest elasticities and expectational errors) are banished from the model*" (p. 2). The financial dynamic fundamentals entail all the dimensions identified by the Financial Development and Structure Database (FDSD) of the World Bank (WB).

3.2 Data

We investigate 5 CEMAC and 6 UEMOA countries with data from African Development Indicators (ADI) and the FDSD of the WB for the period 1980-2010. The

descriptive statistics and details of the countries are presented in Panel A and Panel B respectively of Appendix 1. The definition of the variables and corresponding sources are detailed in Appendix 2. Consistent with the literature, the dependent variables are measured by real GDP output and the annual percentage change in the Consumer Price Index (CPI) (Bordo & Jeanne, 2002; Bae et al., 2005; Hendrix et al., 2009).

For clarity in presentation, the exogenous variables are discussed in terms of financial depth (money), financial activity (credit), financial allocation efficiency and financial size. Firstly, from a financial depth standpoint, the study is in line with the FDSD and recent African finance literature (Asongu, 2013a,b) in measuring financial depth both from overall-economic and financial system perspectives with indicators of broad money supply (*M2/GDP*) and financial system deposits (*Fdgdp*) respectively. Whereas the former denotes the monetary base *(M0)* plus demand, saving and time deposits, the latter represents liquid liabilities (or deposits) of the financial system[9]. Secondly, credit is measured in terms of financial intermediary activity. Therefore, the study seeks to lay emphasis on the ability of banks to grant credit to economic operators. We proxy both for banking-system-activity and financial-system-activity with "private domestic credit by deposit banks: *Pcrb*" and "private credit by deposit banks and other financial institutions: *Pcrbof*" respectively. Thirdly, financial size is measured in terms of deposit bank assets (credit) as a proportion of total assets (deposit bank assets plus central bank assets). Fourthly, financial efficiency[10] appreciates the ability of deposits (money) to be transformed into credit (financial activity). This fourth indicator measures the fundamental role of banks in transforming mobilized deposits into credit for economic operators. We take into account indicators of banking-

[9] It is relevant to distinguish between these two aggregates of money supply because, since we are dealing exclusively with developing (African) countries, a great chunk of the monetary base does not transit via formal banking institutions.

[10] By financial efficiency in this context, we neither refer to the profitability-related concept (notion) nor to the production efficiency of decision making units in the financial sector (through Data Envelopment Analysis: DEA).

system-efficiency and financial-system-efficiency (respectively 'bank credit on bank deposits: *Bcbd'* and 'financial system credit on financial system deposits: *Fcfd'*). With the exception of financial size, the correlation matrices presented in Appendix 3 show that the two measures adopted for each financial dynamic can be used to robustly check each other due to the high degree of substitution.

3.3 Methodology

The estimation strategy typically follows mainstream literature on testing the short-run effects of monetary policy variables on output and prices (Starr, 2005) and the long-run neutrality of monetary policy (Nogueira, 2009). The technique involves unit root and cointegration tests that assess the stationary properties and long-term relationships (equilibriums) respectively. In these investigations, the Vector Error Correction Model (VECM) is applied for long-run effects whereas simple Granger causality is used for short-term effects. Whereas application of the former model requires that the variables exhibit unit roots in levels (and have a long-run relationship (cointegration)), the latter is applied on the condition that variables are stationary (or do not exhibit unit roots). Impulse response functions are further used to assess the tendencies of significant Granger causality findings.

4. Empirical Analysis

4.1 Unit root tests

We assess the stationary properties using two types of first generation panel unit root tests. When the variables exhibit unit roots in levels, we proceed to examine their stationary properties in first difference. A condition for the employment of the VECM is that the variables should exhibit a unit root in levels and be stationary in first difference. Two main types of panel unit root tests are generally used: a first generation (that assumes cross-sectional independence) and a second generation (based on cross-sectional dependence). A precondition for the use of the latter generation test is a cross-sectional dependence test which

is applicable only if the number of cross-sections (N) in the panel is above the number of periods in the cross-sections (T). Given that we have 31 periods (T) and 5 (or 6) cross-sections (N), we are compelled to focus on the first generation tests. Accordingly, both the Levin, Lin & Chu (LLC, 2002) and Im, Pesaran & Shin (IPS, 2003) tests are applied. Whereas the former is a homogenous oriented panel unit root test (common unit roots as null hypothesis), the latter is a heterogeneous based test (individual unit roots as null hypotheses). When the results are different, IPS (2003) takes precedence over LLC (2002) in decision making because in accordance with Maddala & Wu (1999), the alternative hypothesis of LLC (2002) is too strong. Consistent with Liew (2004), goodness of fit (or optimal lag selection) is ensured by the Hannan-Quinn Information Criterion (HQC) and the Akaike Information Criterion (AIC) for the LLC (2002) and IPS (2003) tests respectively.

Table 1: Panel unit root tests

		Panel A: Unit root tests for CEMAC								
		LLC tests for homogenous panel								
		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	**-1.613***	-0.336	**-1.387***	-1.120	**-4.85*****	**-4.83*****	0.416	**-7.72*****	2.165
	ct	1.217	2.063	-0.324	2.899	-1.002	-1.133	3.256	**-7.25*****	0.685
First difference	c	**-5.05*****	**-7.43*****	**-10.4*****	**-7.74*****	0.476	0.191	**-6.30*****	na	**-7.71*****
	ct	**-4.49*****	**-6.01*****	**-6.40*****	**-6.23*****	**-1.52****	-1.737	**-6.21*****	na	**-6.36*****
		IPS tests for heterogeneous panel								
		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	**-1.92****	-0.470	-0.348	-0.614	**-4.16*****	**-4.20*****	0.134	**-7.03*****	3.645
	ct	1.674	2.853	-0.298	0.314	**-1.35***	**-1.479***	3.093	**-5.97*****	1.421
First difference	c	**-4.19*****	**-6.54*****	**-9.24*****	**-8.58*****	na	na	**-5.97*****	na	**-8.16*****
	ct	**-3.32*****	**-4.76*****	**-6.39*****	**-8.33*****	na	na	**-5.11*****	na	**-7.01*****

		Panel B: Unit root tests for UEMOA								
		LLC tests for homogenous panel								
		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	1.282	1.282	**-4.69*****	**-3.04*****	**-1.559***	**-1.579***	2.453	**-7.82*****	3.735
	ct	1.475	1.475	**-3.15*****	**-1.422***	2.132	2.201	1.627	**-6.73*****	0.308
First difference	c	**-5.27*****	**-6.65*****	na	na	**-7.43*****	**-7.33*****	**-8.78*****	na	**-8.21*****
	ct	**-6.28*****	**-4.51*****	na	na	**-7.69*****	**-7.65*****	**-8.36*****	na	**-6.90*****
		IPS tests for heterogeneous panel								
		F. Depth (Money)		Fin. Efficiency		F. Activity (Credit)		F. Size	Inflation	Output
		M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	(CPI)	GDP
Level	c	0.457	0.457	**-3.30*****	**-2.25****	-0.104	-0.112	2.764	**-6.81*****	4.933
	ct	1.247	1.247	**-1.422***	-0.556	2.484	2.529	3.640	**-5.43*****	0.236
First difference	c	**-5.80*****	**-5.97*****	na	**-3.51*****	**-6.36*****	**-6.30*****	**-7.40*****	na	**-8.25*****
	ct	**-5.17*****	**-4.03*****	na	**-5.05*****	**-5.42*****	**-5.39*****	**-7.79*****	na	**-7.13*****

Notes: ***, **, * denote significance at 1%, 5% and 10% respectively. 'c' and 'ct': 'constant' and 'constant and trend' respectively. Maximum lag is 8 and optimal lags are chosen with the HQC for LLC test and the AIC for IPS test. LLC: Levin, Lin & Chu (2002). IPS: Im,

Pesaran & Shin (2003). M2: Money Supply. Fdgdp: Liquid Liabilities. BcBd: Banking System Efficiency. FcFd: Financial System Efficiency. Pcrb: Banking System Activity. Pcrbof: Financial System Activity. Dbacba: Deposit Bank Assets on Total Assets. CPI: Consumer Price Inflation. GDP: Gross Domestic Product. CEMAC: Economic and Monetary Community of Central African States. UEMOA: Economic and Monetary Community of West African States

Table 1 above shows results for the panel unit root tests. Whereas Panel A presents the findings for the CEMAC region, those of Panel B are for the UEMOA zone. For the two monetary zones, whereas the financial variables and 'real output' are overwhelmingly integrated in the first order (i.e: they can be differenced once to be stationary), inflation is stationary in levels. These findings broadly indicate the possibility of cointegration (long-run equilibrium) relationships among the financial variables and real output because; consistent with the Engle-Granger theorem, two variables that are not stationary in levels may have a linear combination in the long-run (Engle & Granger, 1987).

4.2 Cointegration tests

For long-run causality, let us consider output (y) and money (x), such that:

$$y_t = \beta_{y0} + \beta_{yy1} y_{t-1} + \ldots + \beta_{yyp} y_{t-p} + \beta_{yx1} x_{t-1} + \ldots + \beta_{yxp} x_{t-p} + v_t^y \quad (1)$$

$$x_t = \beta_{x0} + \beta_{xy1} y_{t-1} + \ldots + \beta_{xyp} y_{t-p} + \beta_{xx1} x_{t-1} + \ldots + \beta_{xxp} x_{t-p} + v_t^x \quad (2)$$

We adopt the subscript convention that *βxyp* represents the coefficient of the output (y) in the equation for money (x) at lag p. Given that we are dealing with bivariate analysis, the two equations above are replicated for output and each monetary policy variable. The error terms in Eqs (1) and (2) represent the parts of yt and xt that are not related to past values of the two variables: the unpredictable "innovation" in each variable. The intuition for exogeneity has already been discussed in the data section. When the output variable and monetary policy indicators of the VAR are cointegrated, we use the following vector error-correction (VEC) to estimate short-run adjustments to the long-run equilibrium.

$$\Delta y_t = \beta_{y0} + \beta_{y1} \Delta y_{t-1} + \ldots + \beta_{yp} \Delta y_{t-p} + \gamma_{y1} \Delta x_{t-1} + \ldots + \gamma_{yp} \Delta x_{t-p} - \lambda_y \left(y_{t-1} - \alpha_{\grave{a}} - \alpha_1 x_{t-1} \right) + v_t^y \quad (3)$$

$$\Delta x_t = \beta_{x0} + \beta_{x1} \Delta y_{t-1} + \ldots + \beta_{xp} \Delta y_{t-p} + \gamma_{x1} \Delta x_{t-1} + \ldots + \gamma_{xp} \Delta x_{t-p} - \lambda_x \left(y_{t-1} - \alpha_{\grave{a}} - \alpha_1 x_{t-1} \right) + v_t^x \quad (4)$$

where $y_t = \alpha_0 + \alpha_1 x_t$ is the long-run cointegrating nexus between the two variables and λ_y and λ_x are the error-correction parameters that measure how y (output) and x (money) react to deviations from the long-run equilibrium. At equilibrium, the value of the error correction term (ECT) is zero. When this term is non-zero, it implies output and money have deviated from the long run equilibrium. Hence, the ECT helps each variable to adjust and partially restore the equation (cointegration) relationship. We shall replicate the same models (1 to 4) for all pairs of economic activity and monetary policy (depth, efficiency, activity and size). Similar deterministic trend assumptions used for cointegration tests will be applied and goodness of fit (in model specification) is based on the AIC[11] (Liew, 2004).

The cointegration theory as highlighted above suggests that two (or more) variables that have a unit root in levels may have a linear combination (equilibrium) in the long-run. Accordingly, if two variables are cointegrated, it implies permanent movements in one of the variables affect permanent variations in the other variable and vice-versa. To investigate the potential long-run relationships, we test for cointegration using the Engle-Granger based Pedroni test, which is a heterogeneous panel-based test. While we have earlier employed both homogenous and heterogeneous panel based unit roots tests in Section 4.1, we disagree with Camarero & Tamarit (2002) in applying a homogenous Engle-Granger based Kao panel cointegration test because, it has less deterministic components. In principle, application of Kao (1999) in comparison to Pedroni (1999) presents substantial issues in deterministic assumptions[12]. Similar deterministic trend assumptions employed for the IPS (2003) unit root tests are used in the Pedroni (1999) heterogeneous cointegration test. The choice of bivariate statistics has a twofold justification (advantage): on the one hand, it is in line with the

[11] Akaike Information Criterion.
[12] Pedroni (1999) is applied in the presence of both ‘constant’ and ‘constant and trend’ whereas, Kao (1999) is based only on the former (constant).

problem statements (hypotheses) and on the other hand, it mitigates misspecification issues in causality estimations[13].

[13] For example, multivariate cointegration and the corresponding VECM may involve variables that are stationary in levels (See Gries et al., 2009).

Table 2: Bivariate heterogeneous Pedroni Engle-Granger based panel cointegration tests for the CEMAC and UEMOA zones

Panel A: Cointegration between Monetary Policy and Output for the CEMAC zone

	Financial Depth (Money) & Output				Financial Allocation Efficiency & Output				Financial Activity (Credit) & Output				Fin. Size & Output	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking Activity		Financial Activity			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Panel v-Stats	0.934	0.898	-0.527	0.874	-0.468	0.632	-0.044	-0.185	na	na	na	na	-0.938	**2.555*** **
Panel rho-Stats	-0.164	-0.163	1.588	0.383	0.815	0.562	0.943	1.116	na	na	na	na	1.337	-0.030
Panel PP-Stats	-0.341	-0.232	2.320	-0.404	1.140	-0.017	1.408	0.769	na	na	na	na	1.795	-0.987
Panel ADF-Stats	-0.802	**-1.552***	2.290	-1.112	1.176	-0.122	0.720	0.532	na	na	na	na	1.708	-0.871
Group rho-Stats	0.879	0.590	2.548	1.221	1.462	1.606	1.879	2.085	na	na	na	na	2.285	0.417
Group PP-Stats	0.263	-0.017	3.482	-0.002	1.970	0.872	2.283	1.780	na	na	na	na	2.849	-1.08
Group ADF-Stats	-0.872	**-1.448***	3.554	-1.140	2.006	0.695	1.265	1.632	na	na	na	na	2.700	-0.964

Panel B: Cointegration between Monetary Policy and Output for the UEMOA zone

	Financial Depth (Money) & Output				Financial Allocation Efficiency & Output				Financial Activity (Credit) & Output				Fin. Size & Output	
	Money Supply		Liquid Liability		Banking System		Financial System		Banking Activity		Financial Activity			
	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct	c	ct
Panel v-Stats	0.698	-1.240	-0.154	1.203	na	na	-0.279	**1.337***	-0.213	**1.844****	-0.213	**1.849****	-0.959	**2.446*****
Panel rho-Stats	-0.235	0.621	1.237	-0.768	na	na	1.549	-0.740	1.622	-0.495	1.616	-0.500	1.451	-0.239
Panel PP-Stats	-1.010	-1.014	1.603	-2.270	na	na	2.418	**-1.358***	2.469	**-1.682****	2.460	**-1.695****	1.232	**-2.213****
Panel ADF-Stats	**-2.86*****	**-2.052****	1.098	**-2.52*****	na	na	2.839	**-1.934****	3.036	**-2.074****	3.031	**-2.088****	1.184	**-2.97*****
Group rho-Stats	0.906	1.273	1.650	0.096	na	na	2.431	0.480	2.382	0.607	2.378	0.601	1.894	0.766
Group PP-Stats	-0.319	-0.881	1.767	**-2.189****	na	na	3.610	-0.542	3.542	-1.194	3.536	-1.213	0.931	**-2.85*****
Group ADF-Stats	**-1.829****	-0.542	1.486	**-2.66*****	na	na	4.001	-1.253	4.189	**-1.918****	4.183	-1.937**	1.016	**-3.53*****

Notes: ***, **, * denote significance at 1%, 5% and 10% respectively. 'c' and 'ct': 'constant' and 'constant and trend' respectively. Fin: Financial. PP: Phillips-Peron. ADF: Augmented Dickey Fuller. No deterministic trend assumption. CEMAC: Economic and Monetary Community of Central African States. UEMOA: Economic and Monetary Community of West African States.

Table 2 above presents the cointegration findings for the monetary policy variables and output[14]. While Panel A presents those of the CEMAC region, Panel B shows findings for the UEMOA zone. It can be observed that there is overwhelming support for the null hypotheses of no cointegration in both monetary zones. These results are broadly in line with the predictions of economic theory which suggest that monetary policy has no incidence on real output in the long-run. In other words, the absence of a long-run relationship between the monetary policy variables and output confirms the long-term neutrality of money. It follows that in the CFA zones; permanent variations in financial intermediary dynamics (exogenous to monetary policy) do not affect permanent movements in real GDP output in the long-run. It is interesting to note that we have not involved the inflation dimension of economic activity in the cointegration tests because inflation is stationary in levels series (see Table 1). Overall, in the absence of any cointegration relationship among economic activity (output & inflation) and the monetary policy variables, we do not proceed to examine short-run adjustments with the VECM. Consistent with the Engle Granger theorem, in the absence of cointegration, short-run effects could be assessed by simply Granger causality.

4. 3 Granger Causality for Monetary Policy and Economic Activity

The VAR is also a natural framework for investigating Granger causality. Let us consider the two variable system in Eqs (1) and (2). The first equation models yt (economic activity) as a linear function of its own past values plus past values of x (money). If money Granger causes y, then some or all of the lagged x values have non-zero effects: lagged x affects yt conditional on the effects of lagged y. Therefore, testing for Granger causality in Eqs (1) and (2) amounts to testing the joint blocks of coefficients to see if they are zero or not. The null hypothesis of Eq. (1) is the position that, money does not Granger cause economic activity. A rejection of this null hypothesis is captured by the significant F-statistics, which is

[14] Note should be taken of the fact that, inflation (for both zones) , financial activity (for the CEMAC zone) and, banking system efficiency (for the UEMOA zone) are not taken into account in the cointegration analysis because they are stationary in levels.

the Wald statistics for the joint hypothesis that estimated parameters of lagged values equal zero. Optimal lag selection for goodness of fit is consistent with the recommendations of Liew (2004).

Whereas in mainstream literature the Granger causality model is applied on variables that are stationary (in levels for the most part), within the framework of this study, we are also applying this test to all pairs in 'first difference' equations for three reasons: (1) ensure comparability; (2) consistency with application of the model to stationary variables and; (3) robustness checks in case we might have missed-out something in the unit root test specifications.

Table 3 below presents the Granger causality findings. While Panel A shows findings of the CEMAC zone, Panel B reveals those of the UEMOA region. Based on the findings of Panel A, it can be established that: (1) monetary policy variables (of financial system efficiency and financial size) have a short-term effect on real GDP output and; (2) all monetary policy variables have an incidence on inflation in the short-run. In Panel B: (1) but for money supply, monetary policy variables overwhelmingly have a short-run effect on real GDP output and; (2) only financial activity (at banking and financial system levels) and financial size have an incidence on inflation

Table 3: Short-run Granger causality analysis

	Panel A: Monetary policy and Economic Activity for the CEMAC zone						
	Null Hypothesis: Monetary policy does not cause Real GDP Output						
	Financial Depth (Money)		Financial Efficiency		Fin. Activity (Credit)		Fin. Size
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	**4.841*** **	2.028	**4.279** **	**4.023** **	1.115	1.135	**2.642* **
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	0.493	1.179	0.138	**2.472* **	0.464	0.508	**2.730* **
	Null Hypothesis: Monetary policy does not cause Inflation						
	Financial Depth (Money)		Financial Efficiency		Fin. Activity (Credit)		Fin. Size
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	**3.069* **	**4.071** **	1.257	**6.479*** **	**11.80*** **	**11.90*** **	**2.364* **
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	**4.645** **	**4.381** **	**5.260*** **	**7.700*** **	**12.06*** **	**12.19*** **	**8.676*** **

	Panel B: Monetary policy and Economic Activity for the UEMOA zone						
	Null Hypothesis: Monetary policy does not cause Real GDP Output						
	Financial Depth (Money)		Financial Efficiency		Fin. Activity (Credit)		Fin. Size
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	0.558	0.151	**3.966****	**8.119*****	**7.616*****	**7.630*****	0.998
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	0.519	**3.786****	**3.014***	**4.093****	**6.458*****	**6.467*****	**3.243****
	Null Hypothesis: Monetary policy does not cause Inflation						
	Financial Depth (Money)		Financial Efficiency		Fin. Activity (Credit)		Fin. Size
	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba
Levels	0.284	0.351	0.887	1.076	1.705	1.706	**3.416****
	D[M2]	D[Fdgdp]	D[BcBd]	D[FcFd]	D[Pcrb]	D[Pcrbof]	D[Dbacba]
1st Difference	1.273	1.918	0.398	0.836	**4.109****	**4.109****	**3.230****

Notes. M2: Money Supply. Fdgdp: Liquid liabilities. BcBd: Bank credit on Bank deposit (Banking System Efficiency). FcFd: Financial credit on Financial deposits (Financial System Efficiency). Pcrb: Private domestic credit from deposit banks (Banking System Activity). Pcrbof: Private credit from deposit banks and other financial institutions (Financial System Activity). Dbacba: Deposit bank asset on Total assets (Banking System Size). Fin: Financial. CEMAC: Economic and Monetary Community of Central African States. UEMOA: Economic and Monetary Community of West African States.

Compared to the CEMAC zone, it appears that the UEMOA zone's monetary authority has more policy instruments for offsetting output shocks but less instruments for the management of inflation in the short-run. The Granger causality results and corresponding F-statistics upon which the conclusions are based cannot be used to draw any economic inferences. Hence, the impulse-response functions of such relationships will provide additional information (material) on the scale and timing of responses to shocks.

4.4 Impulse responses

Using a Choleski decomposition on a VAR with ordering: 1) inflation/output, 2) a monetary policy variable; we compute impulse response functions (IRFs) for economic activity and monetary policy. The dotted lines are the two standard deviation bands which are used to measure the significance (Agénor et al., 1997, p. 19). While only one graph in each Appendix will be discussed (that is, the response of economic activity to monetary policy), the presentation of the other complementary graphs is meant to confirm the general stability of the VAR models.

For the CEMAC zone: (1) as shown in Appendix 4 (Appendix 5), a positive shock in financial system allocation efficiency (financial size) will result in the positive incidence on real GDP output in the first year and; (2) from Appendix 6 to Appendix 12, it is broadly clear that a negative shock in the monetary policy variables significantly reduces inflation in the first year. The IFRs for the CEMAC zone are consistent with the predictions of economic theory. Concerning the UEMOA zone: (1) from Appendix 13 to Appendix 17, it is observed that a negative shock in monetary variables significantly decreases output during the first year[15] while a positive shock in financial size increases output for the next two years (Appendix 18) and; (2) a positive shock in monetary policy increases inflation during the first year (Appendices 19 and 20), while a negative shock mitigates inflation during the same period (Appendix 21). The IFRs for the UEMOA zone are also consistent with the predictions of economic theory.

Due to space constraints we cannot discuss the time-dynamic responses of economic activity to each monetary policy shock in detail. However, two important temporary significances are worth mentioning: (1) the responses to the shocks are significant and consistent with the predictions of economic theory for the most part during the first years and; (2) the effect of monetary policy shocks on the temporary component of economic activity generally dissipates within a horizon of 4 to 6 years.

4.5 Robustness checks

In order to ensure that the estimations and corresponding results are robust, the following have been performed or checked. (1) With the exception financial size, for almost every financial variable (depth, efficiency or activity), two indicators have been employed. Therefore, the findings have broadly encompassed measures of monetary policy variables from banking and financial system perspectives. (2) Both homogenous and heterogeneous

[15] An exception is the 'banking system efficiency' negative shock that mitigates inflation for the next two years (see Appendix 14).

assumptions have been taken into account in the unit root tests. (3) Optimal lag selection for model specifications has been in accordance with the goodness of fit recommendations of Liew (2004)[16]. (4) Granger causality has been tested both in level and first difference equations (for reasons already outlined above). (5) Impulse response functions have been used to further examine the tendencies of significant Granger causality results and general stability of the VAR models.

4.6 Discussion and policy implications

4.6.1 Retrospect to tested hypotheses

Hypothesis 1: Monetary policy variables affect prices in the long-run but not in the short-run in the CFA zones.

Firstly, we have not been able to establish whether monetary policy variables affect prices in the long-term because for both CFA zones, the inflation variable has been stationary in levels. Thus the absence of a (an) chaotic (unstable) inflation has limited the feasibility of any cointegration analysis between inflation and the monetary policy variables. Secondly, the overwhelming significant causality flowing from financial variables to prices (especially in the CEMAC zone) in the short-term is not consistent with the predictions of economic theory and/or the second part of *Hypothesis 1*. Hence in light of the above, *Hypothesis 1* is broadly untrue. This invalidity is more visible in the CEMAC zone (relative to all monetary policy variables) than in the UEMOA region (relative to financial dynamics of activity and size).

[16] "*The major findings in the current simulation study are previewed as follows. First, these criteria managed to pick up the correct lag length at least half of the time in small sample. Second, this performance increases substantially as sample size grows. Third, with relatively large sample (120 or more observations), HQC is found to outdo the rest in correctly identifying the true lag length. In contrast, AIC and FPE should be a better choice for smaller sample. Fourth, AIC and FPE are found to produce the least probability of under estimation among all criteria under study. Finally, the problem of over estimation, however, is negligible in all cases. The findings in this simulation study, besides providing formal groundwork supportive of the popular choice of AIC in previous empirical researches, may as well serve as useful guiding principles for future economic researches in the determination of autoregressive lag length"* (Liew, 2004, p. 2).

Hypothesis 2: Monetary policy variables influence output in the short-term but not in the long-run in the CFA zones.

Firstly, the absence of any cointegration between real output and the monetary policy variables in both CFA zones confirm the long-term dimension of *Hypothesis 2* on the neutrality of money. As for the short-run dimension, it is more valid for the UEMOA zone (with the exception of overall money supply) than for the CEMAC region (in which only financial dynamics of 'financial system efficiency' and financial activity support the hypothesis).

4.6.2 Implications for the long-run neutrality of money and business cycles

From a traditional standpoint, economic theory has suggested that monetary policy can affect the business cycle, but not the long-run potential output. Despite a substantial theoretical and empirical consensus on money neutrality (well documented in the literature), the role of money as an informational variable for monetary policy decisions has remained open to debate with empirical studies providing conflicting results. The long-run neutrality of money has been confirmed both for the CEMAC and UEMOA regions. From a business cycle perspective, we have seen that monetary policy can be used to offset output shocks in both CFA zones. However, more policy instruments are available for the UEMOA zone than for its CEMAC counterpart. The latter can use only financial system efficiency and financial activity as policy instruments while the former can use all financial intermediary dynamics considered in the analysis (with the exception of money supply). The ineffectiveness of overall economic money supply (M2) as a policy instrument in offsetting short-term output shocks (in both zones) confirms the existing consensus that a great chunk of money supply in African countries does not transit through formal banking institutions.

4.6.3 Implications for credit expansions and inflationary tendencies (targeting)

There is a general consensus among analysts that significant money stock expansions that are not coupled with sustained credit availability improvements are less likely to have any inflationary effects. This position is broadly true in the long-run since monetary policy variables should theoretically have no incidence on prices in the short-term. From the hypotheses that have been investigated in the study, we could reframe the consensus into an important question that policy makers are most likely to ask today: "would expansionary monetary policy in the CFA zones exert any inflationary pressures on prices in the short-term?" The results broadly indicate that monetary policy can be used in the short-run to affect prices and this is more relevant for the CEMAC zone than it is for the UEMOA region. Hence, the former zone had more policy instruments at its disposal to mitigate soaring food prices that marked the geopolitical landscape of most African countries in 2008 (with riots and social unrests).

4.6.4 Other policy implications: how do the findings reflect the ongoing debate?

The long-term effect (neutrality) of monetary policy on output and the significance of financial variables in affecting short-term output (that are more relevant for the UEMOA zone), are part of our findings that are consistent with the traditional discretionary monetary policy arrangements that favor commitments to price stability and international economic integration. Conversely, the significance of financial variables in affecting short-term prices (that are more relevant for the CEMAC zone) are part of the findings that are consistent with the second strand of the debate which sustains that, non-traditional policy regimes limit the ability of monetary authorities to use policy effectively for long-run inflation targeting. This is factual because we expected monetary policy not to have any impact on inflation in the short-run. From a general standpoint, it could be established that the CEMAC region is more inclined to non-traditional policy regimes while the UEMOA zone dances more to the tune of

traditional discretionary monetary policy arrangements. Evidence of the CEMAC stance is supported by the fact that it has only two policy instruments at its disposal for pursuing either an expansionary or a contractionary policy in the management of short-term output shocks.

4.6.5 Country-specific implications

The surplus liquidity issues substantially documented in the literature on the CFA zones (Fouda, 2009; Saxegaard, 2006), may be due to the weight of political instability in some of the sampled countries. Accordingly, Fielding & Shortland (2005) have confirmed the positive relationship between violent political incidence and excess liquidity. Whereas non-arbitrarily disentangling 'conflict-affected' countries may present analytical and practical difficulties (essentially because few countries in Africa are completely free from conflicts), few would object the extension of the Fielding & Shortland conjecture to Ivory Coast, Mali, Chad and the Republic of Congo given the sampled period.

4.6.6 Fighting surplus liquidity

Consistent with Asongu (2013e), policies devoted to tackling surplus liquidity will be efficient if they are in line with the reasons for holding liquidity: voluntary or involuntary. First, voluntary holding of excess liquidity could be reduced by: easing difficulties encountered by banks in tracking their positions at the central bank that may require them to hold reserves above the statutory thresholds; reinforcement of institutions that would favor interbank lending so as to ease borrowing between banks for contingency purposes and; improve infrastructure so that remote bank branches may not need to hold excess reserves due to transportation problems. Second, involuntary holding of surplus liquidity could also be mitigated by: decreasing the inability of banks to lend, especially in situations where interest rates are regulated[17]; creating conditions to sustain the spread between bonds and reserves so

[17] This is the case of the CEMAC region in which the central bank sets a floor for lending rates and a ceiling for deposit rates above and below which interest rates are negotiated freely.

that commercial banks can invest surplus liquidity in the bond markets; stifling the unwillingness of banks to expand lending by mitigating asymmetric information and lack of competition and; developing regional stock exchange markets to broaden investment opportunities for commercial banks.

4.6.7 Caveats and future directions

The main caveat in this study is that we have only taken into account financial intermediary performance determinants of output and inflation in the analysis. However, in the real world economic activity (from real output and inflation perspectives) is endogenous to a complex set of variables: exchange rates, price controls, wage…etc. Hence, the interactions of financial depth, efficiency, activity and size with other determinants of economic activity could result in other dynamics of consumer price inflation and real output. Therefore, replication of the analysis with other fundamentals of economic activity in a multivariate VAR context would be interesting. Another very relevant future research direction could be to examine whether the findings are relevant to country-specific cases of the sampled CFA zones. In so doing, policy makers could be enlightened more on which particular countries in the CFA zones need more adjustments in their monetary policy macroeconomic fundamentals. It is also worthwhile noting that consistent with Wooldridge (2002), the degrees of freedom may not be optimal for model specification. However, owing to the specific character of the sampled countries (monetary zones), issues in degrees of freedom are not unprecedented (Saxegaard, 2006; Waliullah et al., 2010; Asongu, 2012c) and avoidable.

5. Conclusion

A major lesson of the EMU crisis is that serious disequilibria in a monetary union result from arrangements not designed to be robust to a variety of shocks. With the specter of

this crisis looming substantially and scarring existing monetary zones, the present study has complemented existing literature by analyzing the effects of monetary policy on economic activity (output and prices) in the CEMAC and UEMOA CFA zones. By using a plethora of hitherto unemployed financial dynamics (that broadly reflect money supply), we have provided a significant contribution to the empirics of monetary policy.

Two main hypotheses have been tested. *Hypothesis 1*: Monetary policy variables affect prices in the long-run but not in the short-run in the CFA zones (*Broadly untrue*). This invalidity is more pronounced in CEMAC (relative to all monetary policy variables) than in UEMOA (relative to financial dynamics of activity and size). *Hypothesis 2*: Monetary policy variables influence output in the short-term but not in the long-run in the CFA zones. Firstly, the absence of co-integration among real output and the monetary policy variables in both zones confirm the long-term dimension of the hypothesis on the neutrality of monetary policy. The validity of its short-run dimension is more relevant in the UEMOA zone (with the exception of overall money supply) than in the CEMAC zone (in which only financial dynamics of 'financial system efficiency' and financial activity support the hypothesis).

These findings have two main implications for the ongoing debate on monetary policy. (1) Compared to the CEMAC zone, the UEMOA zone's monetary authority has more policy instruments in offsetting output shocks but fewer instruments for the management of short-run inflation. (2) The CEMAC region is more inclined to non-traditional policy regimes while the UEMOA zone dances more to the tune of traditional discretionary monetary policy arrangements. Moreover we have also discussed other policies implications. (1) On the implications for the long-run neutrality of money and business cycles, the UEMOA zone has more policy instruments than its CEMAC counterpart, since the latter can use only financial system efficiency and financial activity as policy instruments whereas the former can use all financial intermediary dynamics considered in the analysis (with a slight exception of money

supply). (2) Concerning implications for credit expansions and inflation targeting, monetary policy can be used in the short-run to affect prices to a greater extend in the CEMAC zone than in the UEMOA region. (3) The surplus liquidity issues could also be traceable to political instability in some member states.

Appendices

Appendix 1: Summary Statistics and Presentation of Countries

Panel A: Summary Statistics

			CEMAC					UEMOA				
			Mean	S.D	Min.	Max.	Obser.	Mean	S.D	Min.	Max.	Obser.
Economic Activity	Inflation		4.369	8.643	-17.64	41.72	141	4.247	7.020	-7.796	39.16	177
	Real Output		9.422	0.580	7.900	10.37	150	9.543	0.347	8.856	10.36	186
Finance	Fin. Depth	M2	0.159	0.046	0.047	0.282	128	0.234	0.071	0.069	0.446	172
		Fdgdp	0.090	0.049	0.027	0.234	128	0.159	0.058	0.045	0.336	172
	Fin. Efficiency	BcBd	1.255	0.723	0.384	5.411	145	1.191	0.538	0.508	3.693	180
		FcFd	1.231	0.633	0.402	3.979	128	1.139	0.414	0.521	2.330	172
	Fin. Activity	Pcrb	0.109	0.076	0.023	0.316	128	0.179	0.083	0.035	0.412	172
		Pcrbof	0.108	0.075	0.023	0.316	128	0.179	0.083	0.035	0.412	172
	Fin. Size	Dbacba	0.682	0.189	0.152	1.091	139	0.757	0.120	0.435	1.049	180

Panel B: Presentation of countries

CEMAC Zone (5)	Cameroon, Central African Republic, Chad, Equatorial Guinea , Gabon
UEMOA Zone (6)	Burkina Faso, Ivory Coast, Mali, Niger, Senegal, Togo

S.D: Standard Deviation. Min: Minimum. Max: Maximum. Obser : Observations. Fin: Financial. CEMAC: Economic and Monetary Community of Central African States. UEMOA: Economic and Monetary Community of West African States.

Appendix 2: Variable Definitions

Variables	Signs	Variable Definitions	Sources
Inflation	Infl.	Consumer Price Index (Annual %)	World Bank (WDI)
Real Output	Output	Logarithm of Real GDP	World Bank (WDI)
Economic financial depth (Money Supply)	M2	Monetary Base plus demand, saving and time deposits (% of GDP)	World Bank (FDSD)
Financial system depth (Liquid liabilities)	Fdgdp	Financial system deposits (% of GDP)	World Bank (FDSD)
Banking system allocation efficiency	BcBd	Bank credit on Bank deposits	World Bank (FDSD)
Financial system allocation efficiency	FcFd	Financial system credit on Financial system deposits	World Bank (FDSD)
Banking system activity	Pcrb	Private credit by deposit banks (% of GDP)	World Bank (FDSD)
Financial system activity	Pcrbof	Private credit by deposit banks and other financial institutions (% of GDP)	World Bank (FDSD)
Banking System Size	Dbacba	Deposit bank assets/ Total assets (Deposit bank assets plus Central bank assets)	World Bank (FDSD)

Infl: Inflation. M2: Money Supply. Fdgdp: Liquid liabilities. BcBd: Bank credit on Bank deposits. FcFd: Financial system credit on Financial system deposits. Pcrb: Private domestic credit by deposit banks. Pcrbof: Private domestic credit by deposit banks and other financial institutions. WDI: World Development Indicators. FDSD: Financial Development and Structure Database. GDP: Gross Domestic Product. CEMAC: Economic and Monetary Community of Central African States. UEMOA: Economic and Monetary Community of West African States.

Appendix 3: Correlation Matrices

Panel A: CEMAC Zone

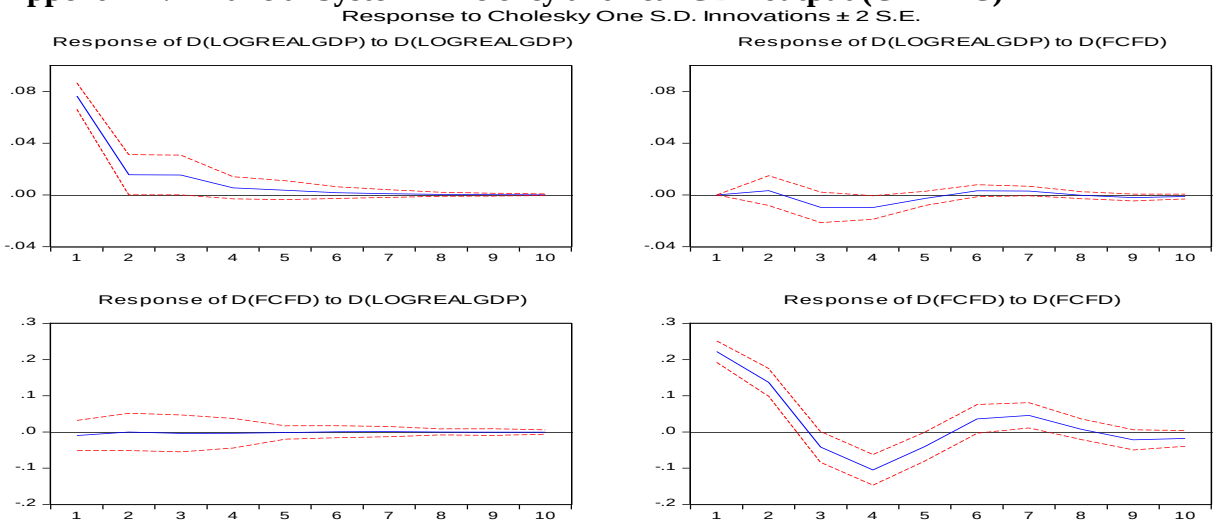
Economic Activity		Financial Depth		Fin. Efficiency		Financial Activity		F. Size	
Inflation	Output	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	
1.000	0.019	-0.134	0.002	-0.214	-0.202	-0.086	-0.086	-0.058	Inflation
	1.000	0.206	0.632	-0.538	-0.561	0.121	0.117	0.559	Output
		1.000	0.612	0.260	0.207	0.630	0.625	0.376	M2
			1.000	-0.065	-0.104	0.722	0.716	0.681	Fdgdp
				1.000	0.931	0.552	0.555	0.061	BcBd
					1.000	0.556	0.561	-0.015	FcFd
						1.000	0.999	0.529	Pcrb
							1.000	0.527	Pcrbof
								1.000	Dbacba

Panel B: UEMOA Zone

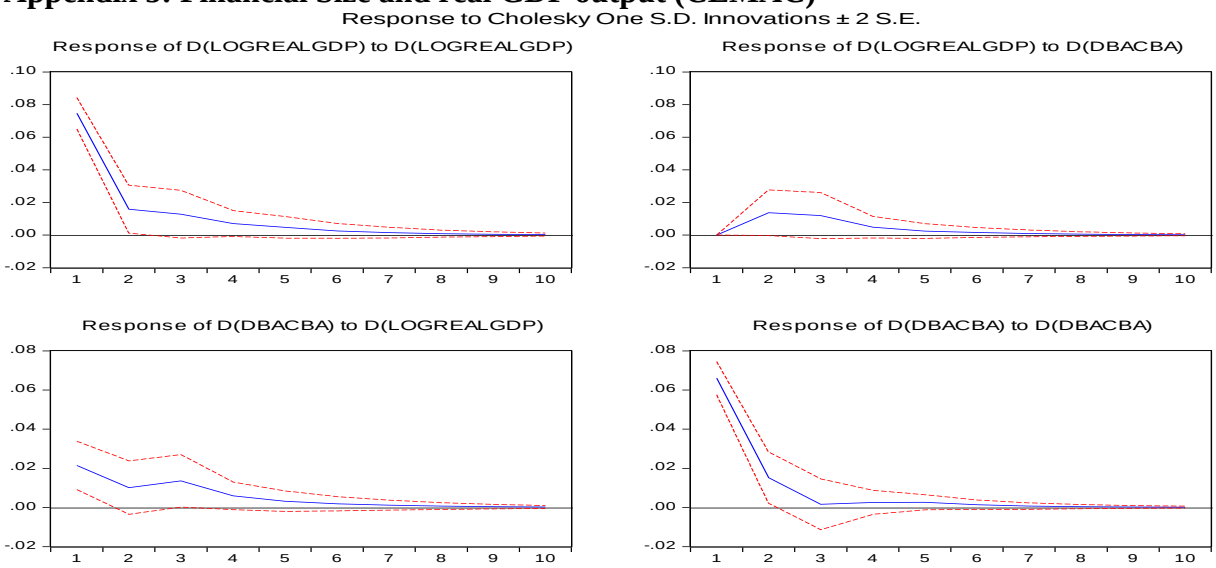
Economic Activity		Financial Depth		Fin. Efficiency		Financial Activity		F. Size	
Inflation	Output	M2	Fdgdp	BcBd	FcFd	Pcrb	Pcrbof	Dbacba	
1.000	-0.107	0.002	-0.038	0.113	0.159	0.113	0.114	-0.011	Inflation
	1.000	0.086	0.048	0.001	0.174	0.236	0.238	0.405	Output
		1.000	0.952	-0.041	-0.058	0.569	0.568	0.356	M2
			1.000	-0.050	-0.069	0.576	0.575	0.337	Fdgdp
				1.000	0.975	0.729	0.728	0.056	BcBd
					1.000	0.742	0.742	0.246	FcFd
						1.000	1.000	0.348	Pcrb
							1.000	0.348	Pcrbof
								1.000	Dbacba

M2: Money Supply. Fdgdp: Liquid liabilities. BcBd: Bank credit on Bank deposit s (Banking System Efficiency). FcFd: Financial credit on Financial deposits (Financial System Efficiency). Pcrb: Private domestic credit from deposit banks (Banking System Activity). Pcrbof: Private credit from deposit banks and other financial institutions (Financial System Activity). Dbacba: Deposit bank asset on Total assets (Banking system size). Fin: Financial. CEMAC: Economic and Monetary Community of Central African States. UEMOA: Economic and Monetary Community of West African States.

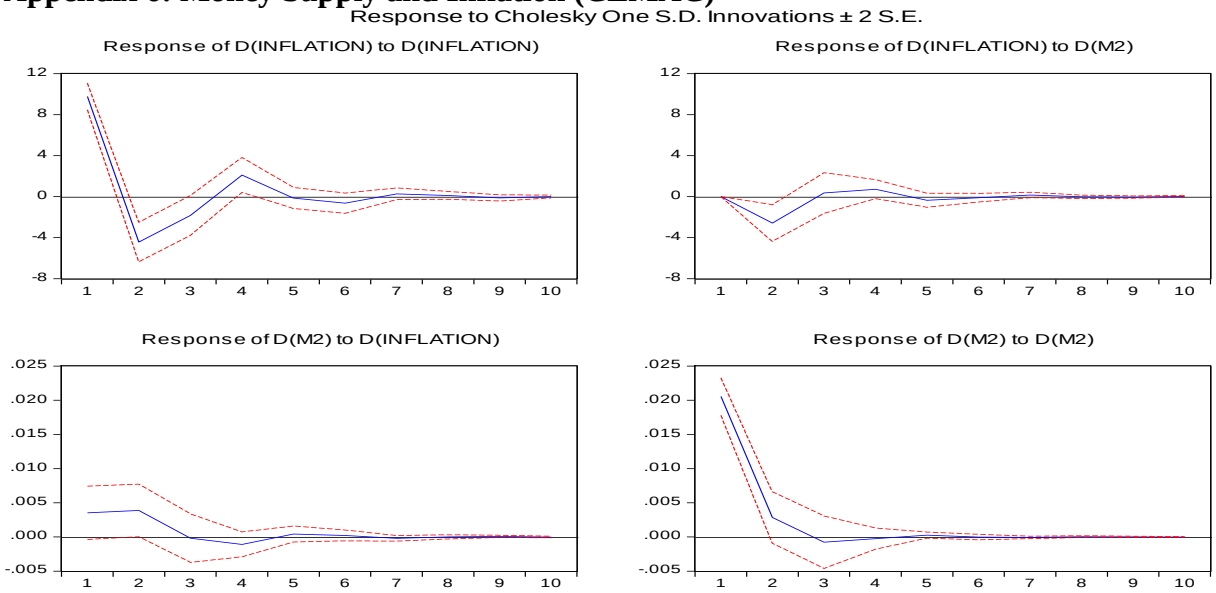
Appendix 4: Financial System Efficiency and real GDP output (CEMAC)



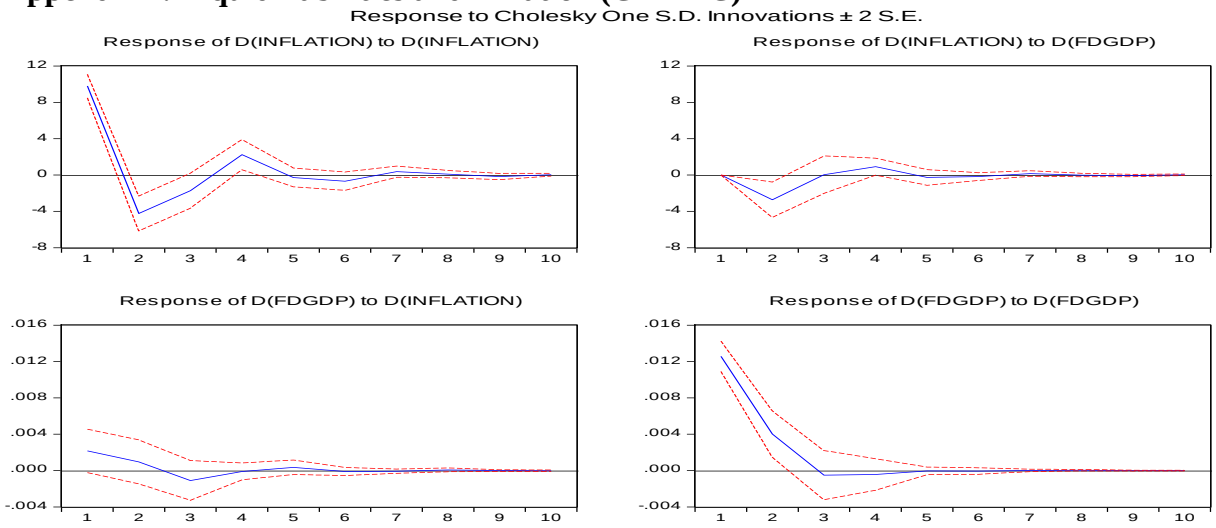
Appendix 5: Financial Size and real GDP output (CEMAC)



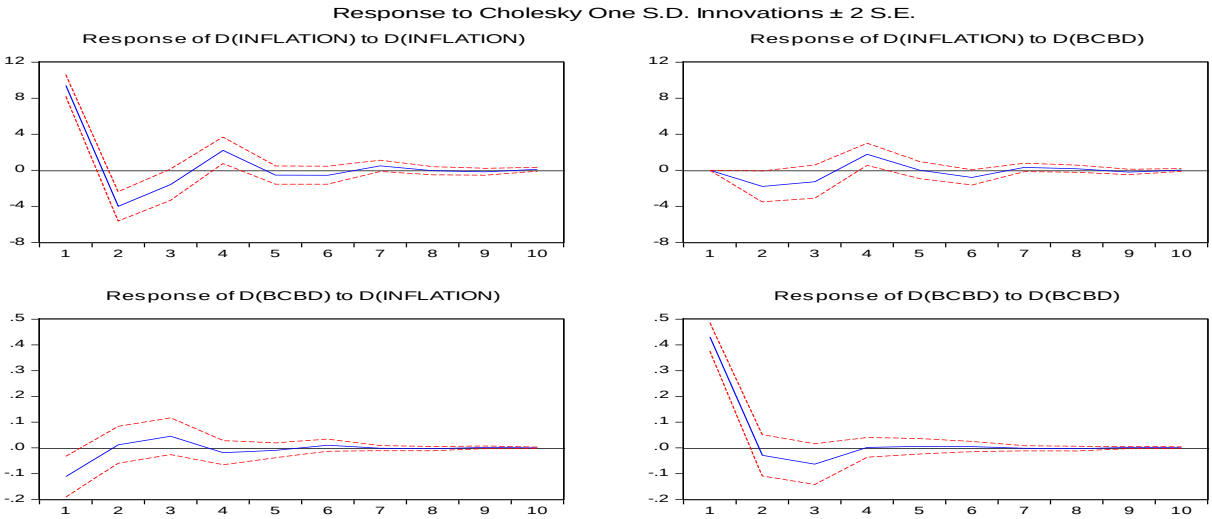
Appendix 6: Money Supply and Inflation (CEMAC)



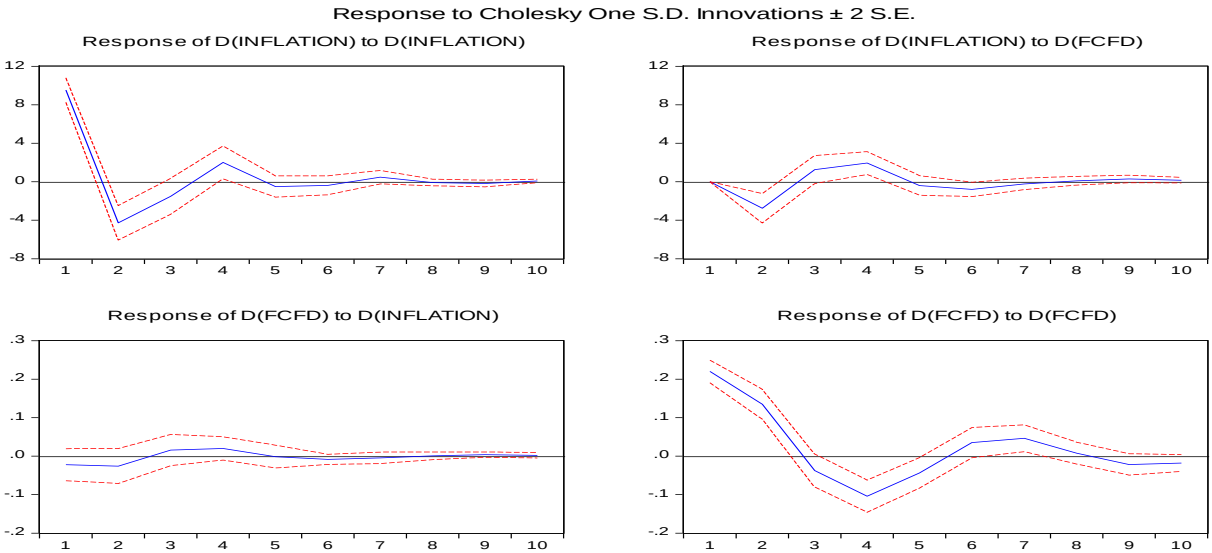
Appendix 7: Liquid liabilities and Inflation (CEMAC)



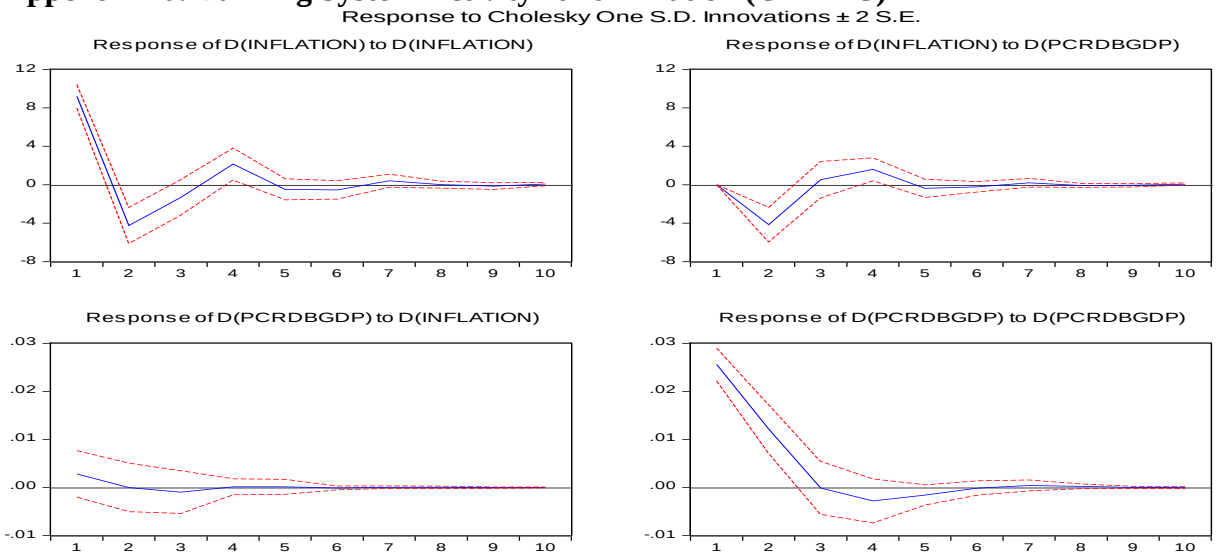
Appendix 8: Banking System Efficiency and Inflation (CEMAC)



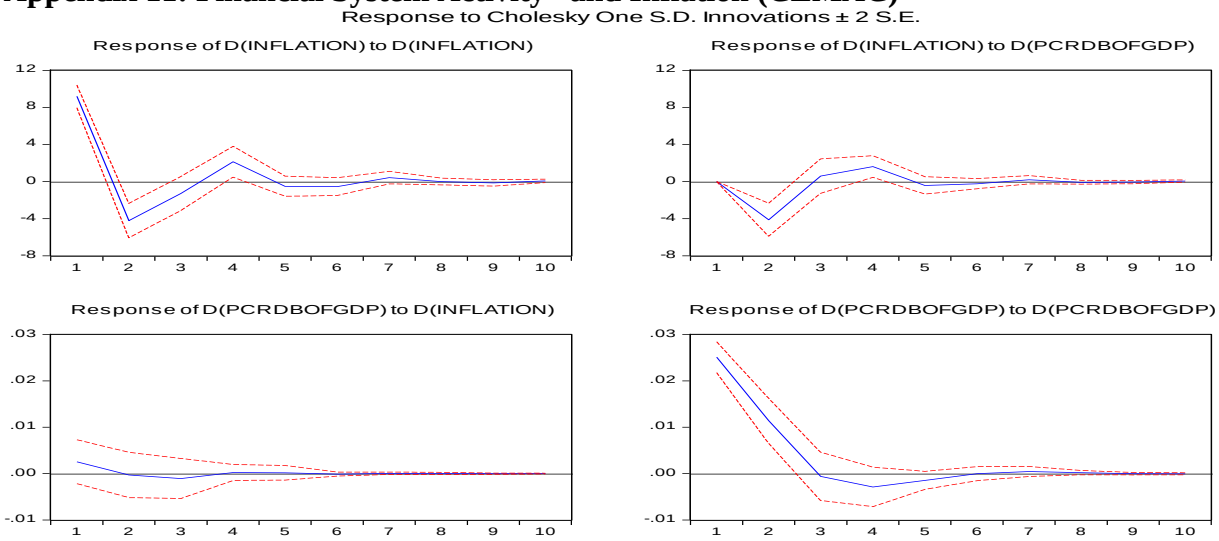
Appendix 9: Financial System Efficiency and Inflation (CEMAC)



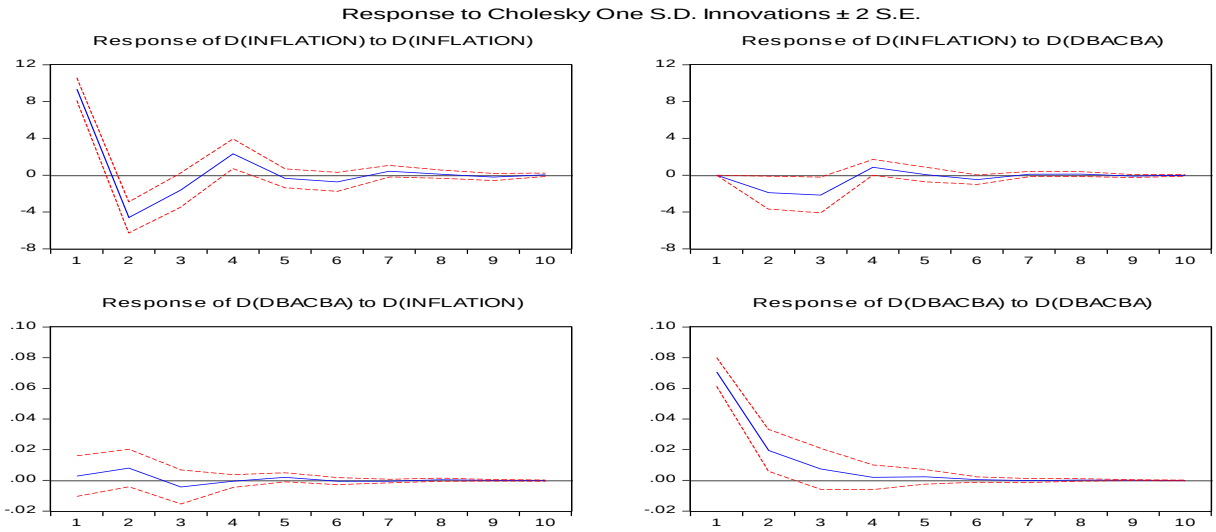
Appendix 10: Banking System Activity and Inflation (CEMAC)



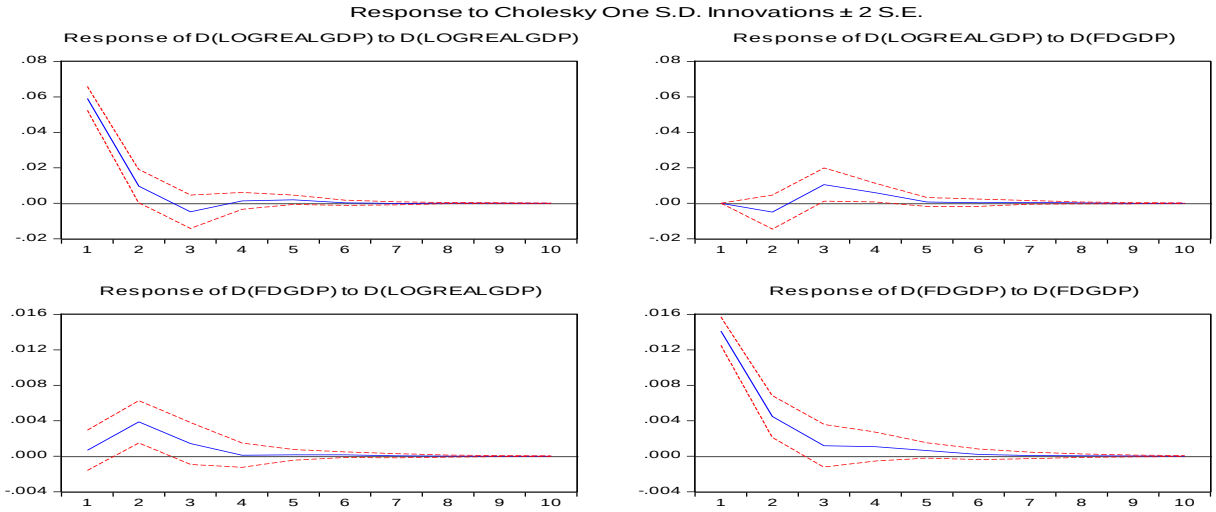
Appendix 11: Financial System Activity and Inflation (CEMAC)



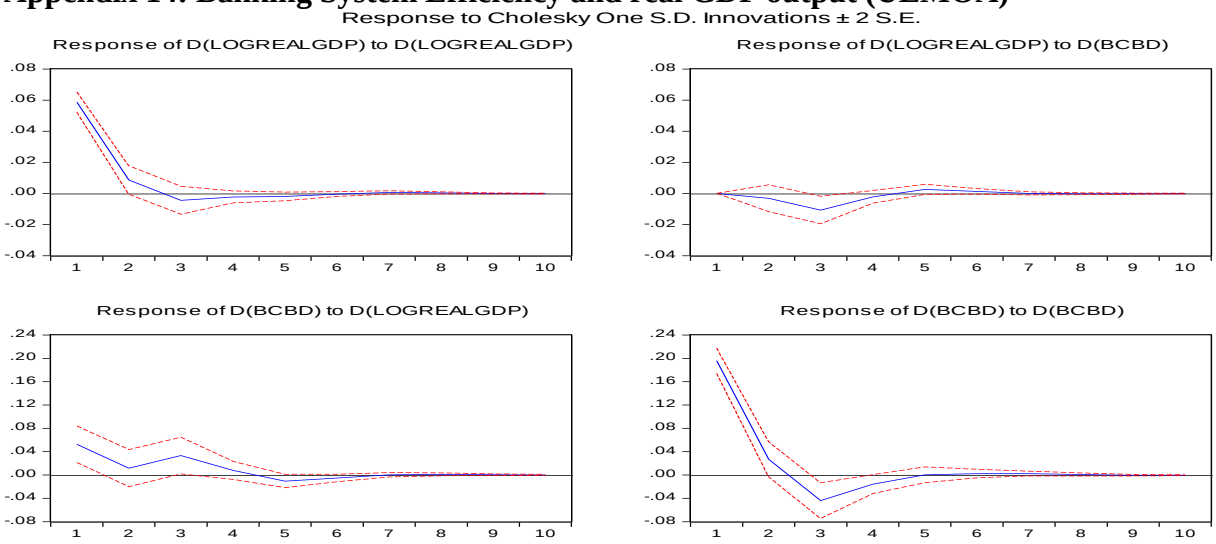
Appendix 12: Financial Size and Inflation (CEMAC)



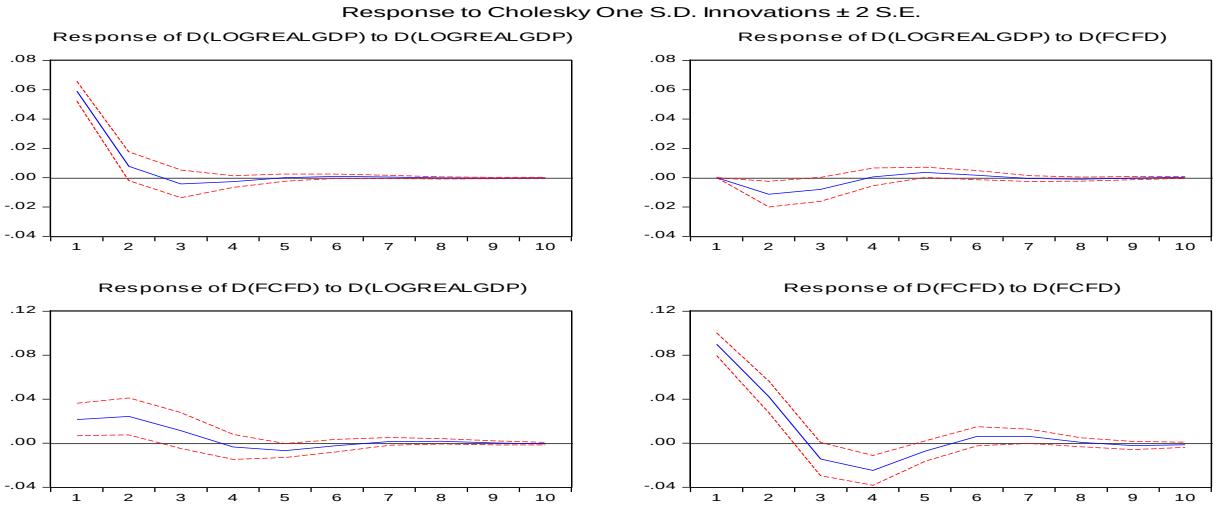
Appendix 13: Liquid Liabilities and real GDP output (UEMOA)



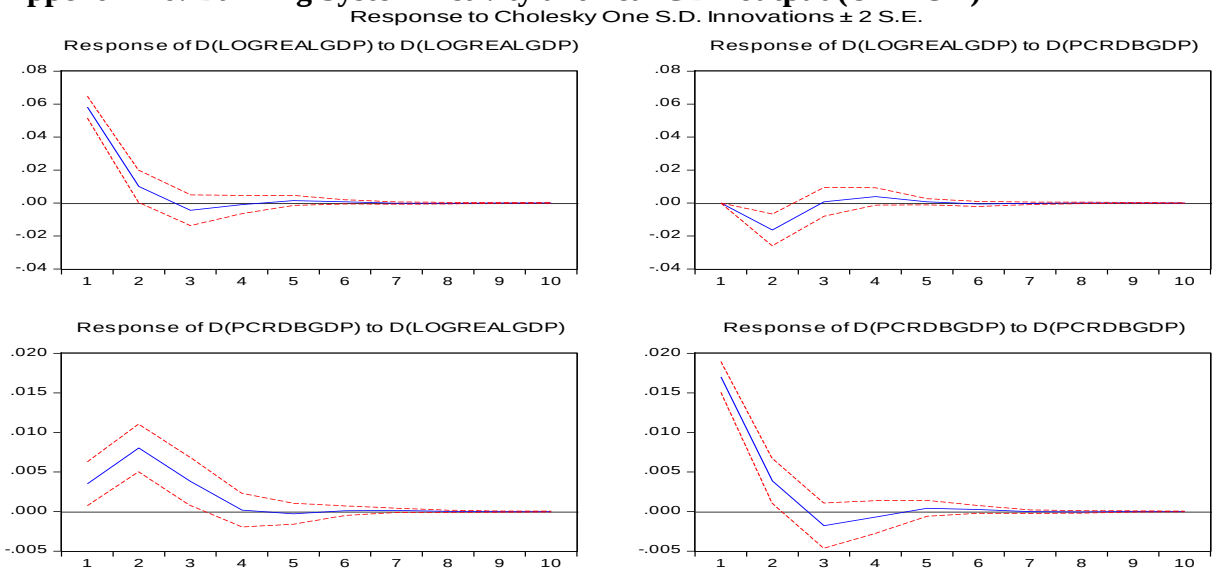
Appendix 14: Banking System Efficiency and real GDP output (UEMOA)



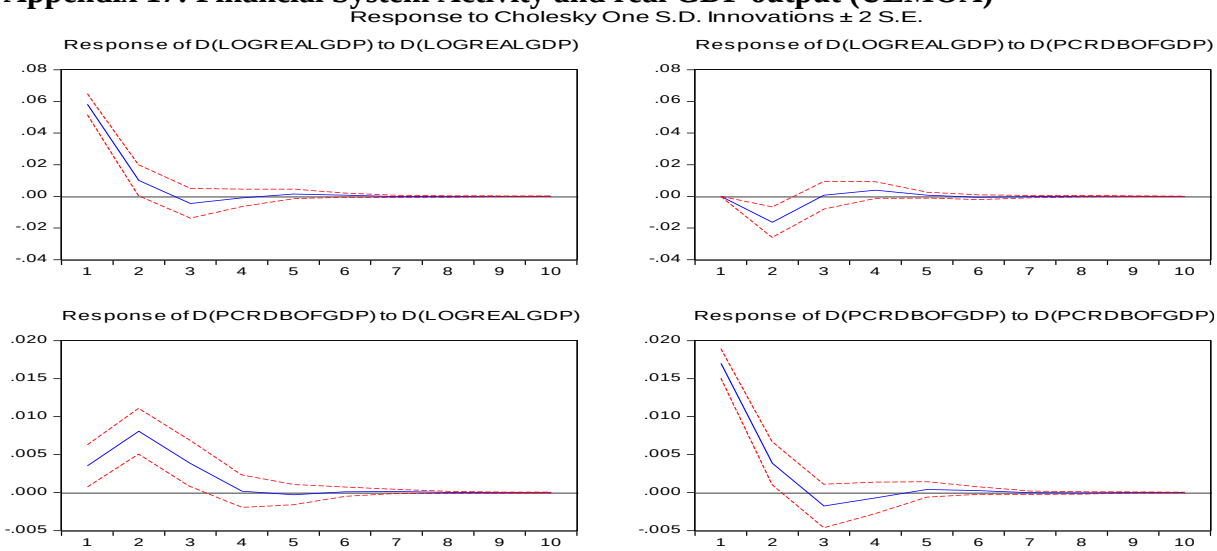
Appendix 15: Financial System Efficiency and real GDP output (UEMOA)



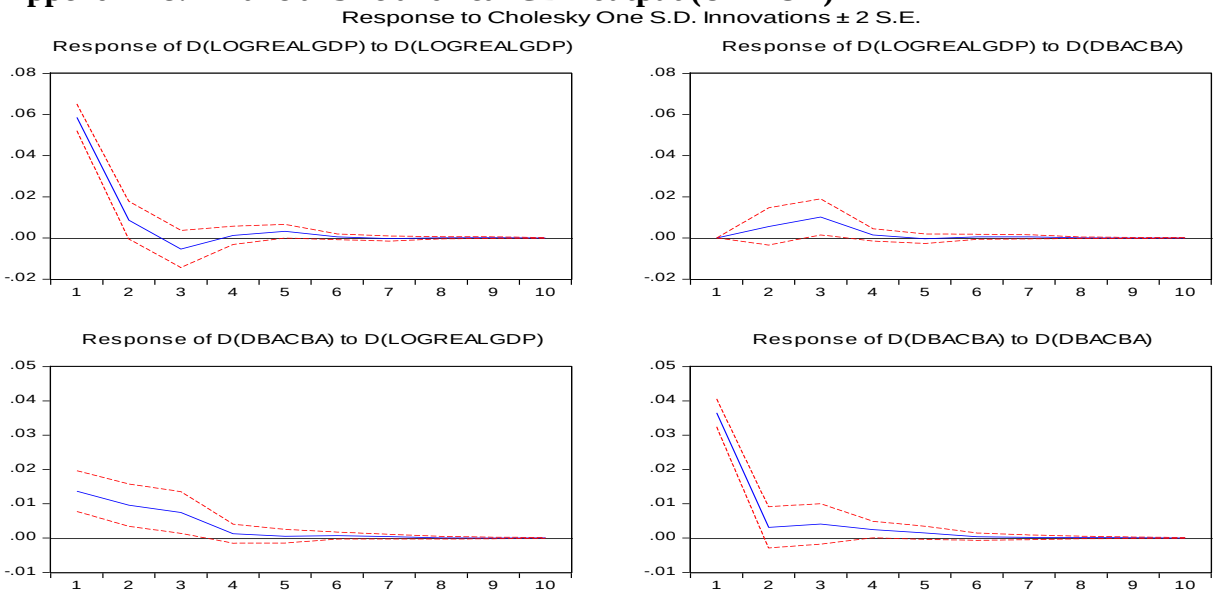
Appendix 16: Banking System Activity and real GDP output (UEMOA)



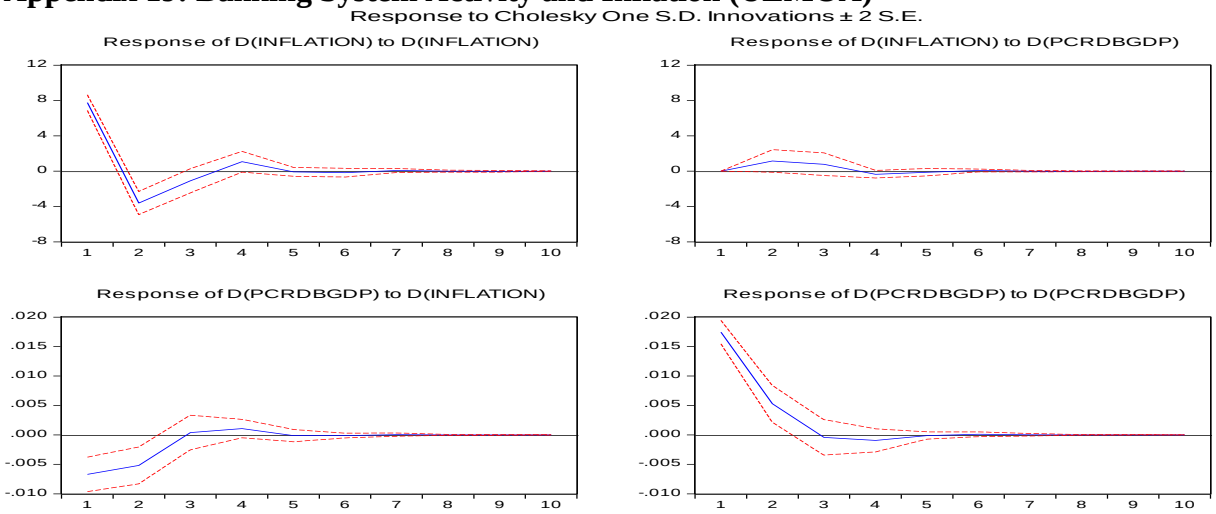
Appendix 17: Financial System Activity and real GDP output (UEMOA)



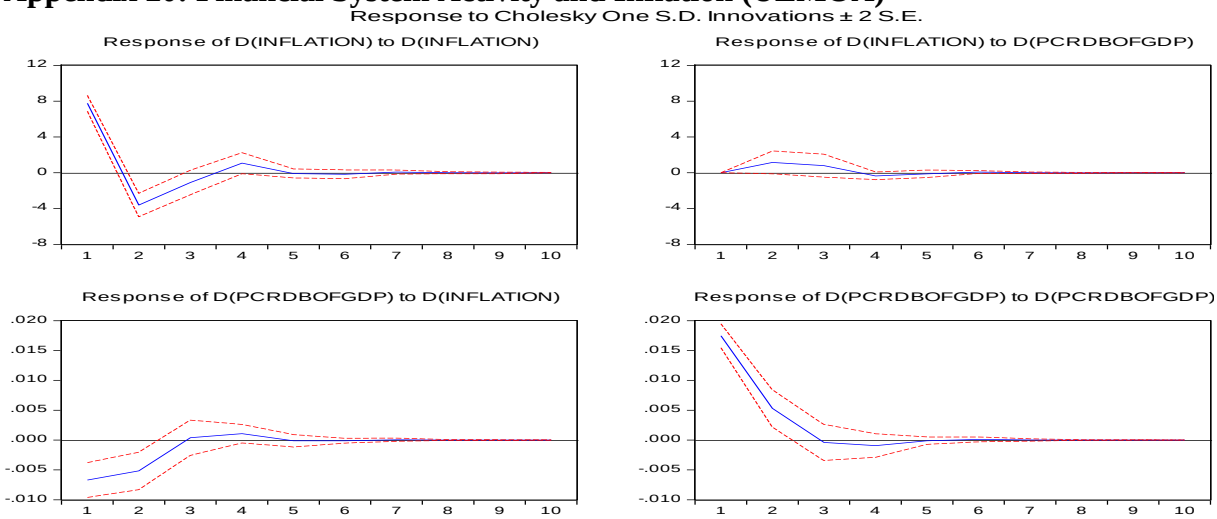
Appendix 18: Financial Size and real GDP output (UEMOA)



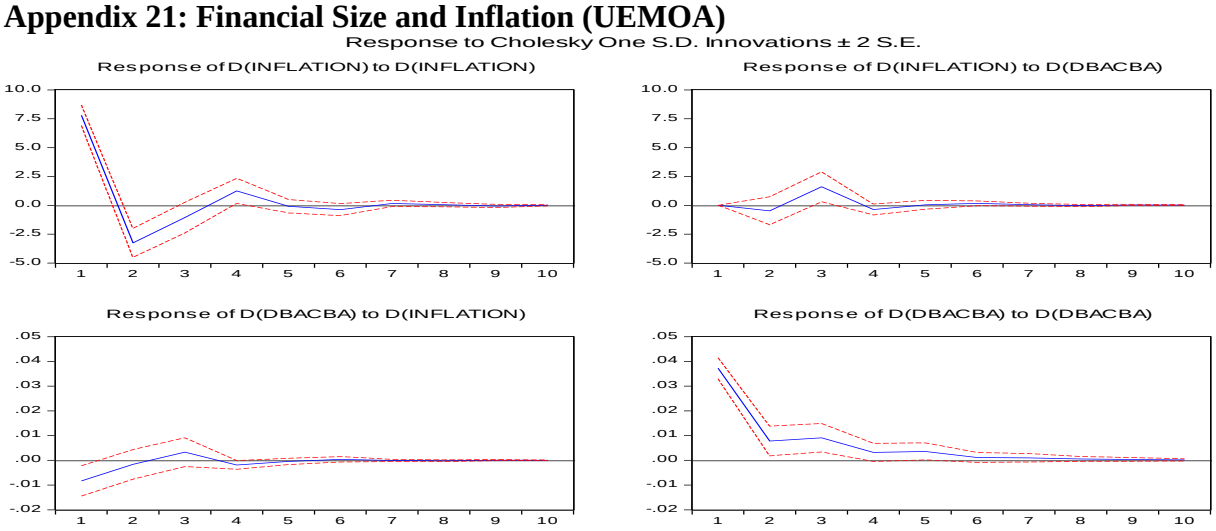
Appendix 19: Banking System Activity and Inflation (UEMOA)



Appendix 20: Financial System Activity and Inflation (UEMOA)



Appendix 21: Financial Size and Inflation (UEMOA)



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